Course Code: 20MB9013 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583
QUESTION BANK (DESCRIPTIVE)

Subject with Code: Operations Research(20MB9013) **Course & Branch**: MBA

Regulation: R20 **Year & Sem:** I-MBA & II-Sem

PART-A

UNIT –I

Introduction to operations Research

1	a)Define Operations Research. b)Discus the scope of Operations Research	**[L1][CO1]** **[L2][CO1]**	**[5M]** **[5M]**
2	Explain the terminologies of linear programming model	**[L2][CO1]**	**[10M]**
3	Define the following (i) Basic variable (ii)Artificial variable (iii) Slack variable (iv)Feasible solution (v) Optimal solution	**[L1][CO1]**	**[10M]**
4	A company manufactures two products P_1 and P_2. Each product uses lathe and milling machine. The processing time per unit of P_1 on the lathe is 5 hours and on the milling machine is 4 hours. The processing time per unit of P_2 on the lathe is 10 hours and on the milling machine is 4 hours. The maximum number of hours available per week on the lathe and the milling machine are 60 hours and 40 hours respectively. Also the profit per unit of selling P_1 and P_2 are Rs.6.00 and Rs. 8.00 respectively. Formulate a linear programming model to determine the production volume of each of the products such that the total profit is maximized.	**[L6][CO1]**	**[10M]**
5	Solve the following Liner Programming Problem (LPP) by using Graphical Method. $Minimize\ Z = 2X_1 + 3X_2$ Subject to constraints $X_1 + X_2 \geq 6,\ 7X_1 + X_2 \geq 14,\ X_1\ and\ X_2 \geq 0$	**[L3][CO1]**	**[10M]**
6	Solve the following Liner Programming Problem (LPP) by using Graphical Method. $Maximize\ Z = 100X_1 + 80X_2$ Subject to constraints $5X_1 + 10X_2 \leq 50,\ 8X_1 + 2X_2 \geq 16, 3X_1 - 2X_2 \geq 6$ $X_1\ and\ X_2 \geq 0$	**[L3][CO1]**	**[10M]**
7	Explain the steps involving in solving Simplex Method	**[L2][CO1]**	**[10M]**
8	Solve the following LP problem using Simplex method $Maximize\ Z = 6X_1 + 8X_2$ Subject to constraints $5X_1 + 10X_2 \leq 60,\ 4X_1 + 4X_2 \leq 40, X_1\ and\ X_2 \geq 0$	**[L3][CO1]**	**[10M]**
9	Solve the following LP problem using Simplex method $Maximize\ Z = X_1 + X_2 + 3X_3$ Subject to constraints $3X_1 + 2X_2 + X_3 \leq 3,\ 2X_1 + X_2 + 2X_3 \leq 2, X_1\ and\ X_2 \geq 0$	**[L3][CO1]**	**[10M]**
10	What are the major applications of Operations Research in business, commerce and industry	**[L1][CO1]**	**[10M]**

UNIT –II
Transportation and Assignment Models

1	What are the types of Transportation Problem? Explain them with suitable examples	**[L1][CO2]**	**[10M]**
2	a) Explain the steps involve in Northwest corner cell method to find the initial basic feasible solution for a transportation problem	**[L2][CO2]**	**[10M]**
3	Explain the steps involve in Least cost cell method to find the initial basic feasible solution for a transportation problem	**[L2][CO2]**	**[10M]**
4	What are the steps involve in Vogel's approximation method to find the initial basic feasible solution for a transportation problem	**[L1][CO2]**	**[10M]**
5	Determine an initial basic feasible solution to the following transportation problem using Northwest corner cell method Destination 1 2 3 4 Supply 1 3 1 7 4 300 Source 2 2 6 5 9 400 3 8 3 3 2 500 Demand 250 350 400 200	**[L3][CO2]**	**[10M]**
6	Find an initial basic feasible solution to the following transportation problem using Least cost cell method To 1 2 3 Supply 1 2 7 4 5 From 2 3 3 1 8 3 5 4 7 7 4 1 6 2 14 Demand 2 9 18	**[L3][CO2]**	**[10M]**
7	Determine an initial basic feasible solution to the following transportation problem using Vogel's approximation method Warehouses W1 W2 W3 W4 Capacity F1 10 30 50 10 7 Factory F2 70 30 40 60 9 F3 40 8 70 20 18 Requirement 5 8 7 14	**[L3][CO2]**	**[10M]**
8	Discuss the steps involve in U-V method to find the optimal solution from the initial basic feasible solution for a transportation problem	**[L2][CO2]**	**[10M]**
9	Discuss the steps of Hungarian method to solve the assignment problem	**[L2][CO2]**	**[10M]**

10	Solve the following assignment problem using Hungarian method. The matrix entries are processing times in hours.	**[L3][CO2]**	**[10M]**

		Operator				
		1	2	3	4	5
Job	1	10	12	15	12	8
	2	7	16	14	14	11
	3	13	14	7	9	9
	4	12	10	11	13	10
	5	8	13	15	11	15

UNIT –III
GAME THEORY

1	Define the following terminologies of game theory (i) Players (ii) Strategy(iii) Maximin principle (iv) Minimax principle(V) Saddle point (Vi) Value of the game(Vii) Two-person zero-sum game (viii) Dominance property	**[L1][CO3][**	**[10M]**
2	Discuss the steps involving in game with pure strategies	**[L2][CO3]**	**[10M]**
3	Find the optimum strategies of the players in the following game B 1 2 3 A 1 30 20 40 2 55 50 60 3 60 30 40	**[L3][CO3]**	**[10M]**
4	Find the optimum strategies of the players in the following game B 1 2 3 A 1 10 5 20 2 65 50 40 3 55 25 30	**[L3][CO3]**	**[10M]**
5	Discuss the steps involving in game with mixed strategies	**[L2][CO3]**	**[10M]**
6	Consider the following payoff matrix with respect to player A and solve it optimally Player B 1 2 Player A 1 6 9 2 8 4	**[L2][CO3]**	**[10M]**
6	Players A and B play a game in which each player has three coins (20p,25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player A b) Find the optimal strategies for the players.	**[L6][CO3]**	**[10M]**
7	Discuss the algorithm for for $2 \times n$ game in Graphical Method	**[L2][CO3]**	**[10M]**
8	Discuss the algorithm for for $m \times 2$ game in Graphical Method	**[L2][CO3]**	**[10M]**

9	Consider the following payoff matrix with respect to player A and solve it optimally Player B Player A 		1	2	3	4	5
---	---	---	---	---	---
1	3	0	6	-1	7
2	-1	5	-2	2	1		[L2][CO3]	**[10M]**
10	Consider the following payoff matrix with respect to player A and solve it optimally Player B Player A |	1	2
---	---	---
1	1	3
2	3	1
3	5	-1
4	6	-6		[L3][CO3]	**[10M]**

UNIT –IV
PROJECT MANAGEMENT

1 Define Project. What are the steps involved in CPM? **[L1][CO4]** **[10M]**

2 Find the Critical Path for the following problem **[L3][CO4]** **[10M]**

Activity	1-2	1-3	2-4	3-4	4-5
Duration	6	2	4	3	4

3 Find the Critical Path and duration of the project. **[L3][CO4]** **[10M]**

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Duration	6	2	4	3	4	3	6

4 What is a project? Explain rules for drawing a network **[L1][CO4]** **[10M]**

5 Draw the network and identify the critical path for the following activities **[L6][CO4]** **[10M]**

Activity	1-2	1-3	2- 3	2- 5	3-4	3- 6	4- 5	4-6	5-6	6-7
Duration (Days)	15	15	3	5	8	12	1	14	3	14

6 Draw the network and identify the critical path for the following problem **[L6][CO4]** **[10M]**

Activity	1-2	1-3	2-3	2-4	3-6	4-5	5-6
Duration	7	7	8	6	9	3	5

7 Draw the network, identify the critical path and total project duration for the following activities **[L6][CO4]** **[10M]**

Activity	1-2	1-3	2- 4	3- 4	3-5	4- 9	5- 6	5-7	6-8	7-8	8-10	9-10
Time (days)	4	1	1	1	6	5	4	8	1	2	5	7

8 Write short notes on a) Project Crashing b) PERT **[L2][CO4]** **[10M]**

9 Determine the optimum project duration and cost for the following data if the indirect cost per week is Rs.160 **[L3][CO4]** **[10M]**

Activity	Normal time (weeks)	Normal Cost (Rs)	Crosh Time (weeks)	Crash Cost (Rs)
1-2	13	700	9	900
1-3	5	400	4	460
1-4	7	600	4	810
2-5	12	800	11	865
3-2	6	900	4	1130
3-4	5	1000	3	1180
4-5	9	1500	6	1800

10 Write short notes on **[L1][CO4]** **[10M]**

a) Steps in PERT
b) Cost slope
c) Project crashing

UNIT –V

REPLACEMENT AND SEQUENCING MODELS

1 The cost of the machine is Rs 61000/- and its scrap value is Rs 1000 at the end of everyyear, The Maintenance cost found from experience are as follows: **[L1][CO5]** **[10M]**

Year	1	2	3	4	5	6	7	8
Maintenance cost in rupees	1000	2500	4000	6000	9000	12000	16000	20000

When should the machine be replaced?

2 Define replacement models? Explain the replacement model types in detail **[L1][CO5]** **[10M]**

3 What are the steps involved in the problems with n jobs through machines A, B, C **[L2][CO5]** **[10M]**

4 Define job sequencing and explain its methods of solution **[L1][CO5]** **[10M]**

5 What are the steps involved in the problems with n jobs through 2 machines **[L1][CO5]** **[10M]**

6 There are 5 jobs, each of which must go through the two machines A and B in the order AB. Processing time are given below. **[L3][CO5]** **[10M]**

Job	1	2	3	4	5
Machine-A	5	1	9	3	10
Machine-B	2	6	7	8	4

Determine the sequence of 5 jobs that will minimizes the total elapsed time

7 Find the sequence that minimizes the total elapsed time (in hours)required to complete the following tasks on 2 machines. **[L3][CO5]** **[10M]**

Job	A	B	C	D	E	F	G	H	I
Machine-1	2	5	4	9	6	8	7	5	4
Machine-2	6	8	7	4	3	9	3	8	11

8 There are five jobs (namely 1,2,3,4 and 5), each of which must go through machines A, B and C in the order ABC. Processing Time (in hours) are given below: **[L2][CO5]** **[10M]**

Jobs/Machine	1	2	3	4	5
Machine-A	5	7	6	9	5
Machine-B	2	1	4	5	3
Machine-C	3	7	5	6	7

Find the sequence of that will minimize the total elapsed time.

9 A fleet owner finds from his past experience records that the cost of the machine is Rs 6000/- and the running cost are given below. At what age the replacement is due;- **[L1][CO5]** **[10M]**

year	1	2	3	4	5	6	7	8
Maintenance cost	1000	1200	1400	1800	2300	2800	3400	4000
Resale value	3000	1500	750	375	200	200	200	200

10 **[L4][CO5]** **[10M]**

A) Why should manufacturers go for replacement?
B) What is the importance of time value of money in replacement?

PART-B

CASE STUDY-1

Solve the following Liner Programming Problem (LPP) by using Graphical Method.

Minimize $Z = 2X_1 + 3X_2$

Subject to constraints $X_1 + X_2 \geq 6,\ 7X_1 + X_2 \geq 14,\ X_1\ and\ X_2 \geq 0$

CASE STUDY-2

Players A and B play a game in which each player has three coins (20p, 25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin.

a) Develop a payoff matrix with respect to player A

b) Find the optimal strategies for the players.

CASE STUDY-3

Determine the optimum project duration and cost for the following data if the indirect cost per week is Rs.160

Activity	Normal time (weeks)	Normal Cost (Rs)	Crash Time (weeks)	Crash Cost (Rs)
1-2	13	700	9	900
1-3	5	400	4	460
1-4	7	600	4	810
2-5	12	800	11	865
3-2	6	900	4	1130
3-4	5	1000	3	1180
4-5	9	1500	6	1800

CASE STUDY-4

There are five jobs (namely 1,2,3,4 and 5), each of which must go through machines A, B and C in the order ABC. Processing Time (in hours) are given below:

Jobs/Machine	1	2	3	4	5
Machine-A	5	7	6	9	5
Machine-B	2	1	4	5	3
Machine-C	3	7	5	6	7

Find the sequence of that will minimize the total elapsed time.